PORTO RICO AGRICULTURAL EXPERIMENT STATION.
D. W. May, Special Agent in Charge.
Mayaguez, June, 1911.

CIRCULAR No. 13.

BEE KEEPING IN PORTO RICO

BY

W. V. TOWER.

UNDER THE SUPERVISION OF
OFFICE OF EXPERIMENT STATIONS.
U. S. DEPARTMENT OF AGRICULTURE.

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(Under the supervision of A. C. TRUE, Director of the Office of Experiment Stations, United States Department of Agriculture.)

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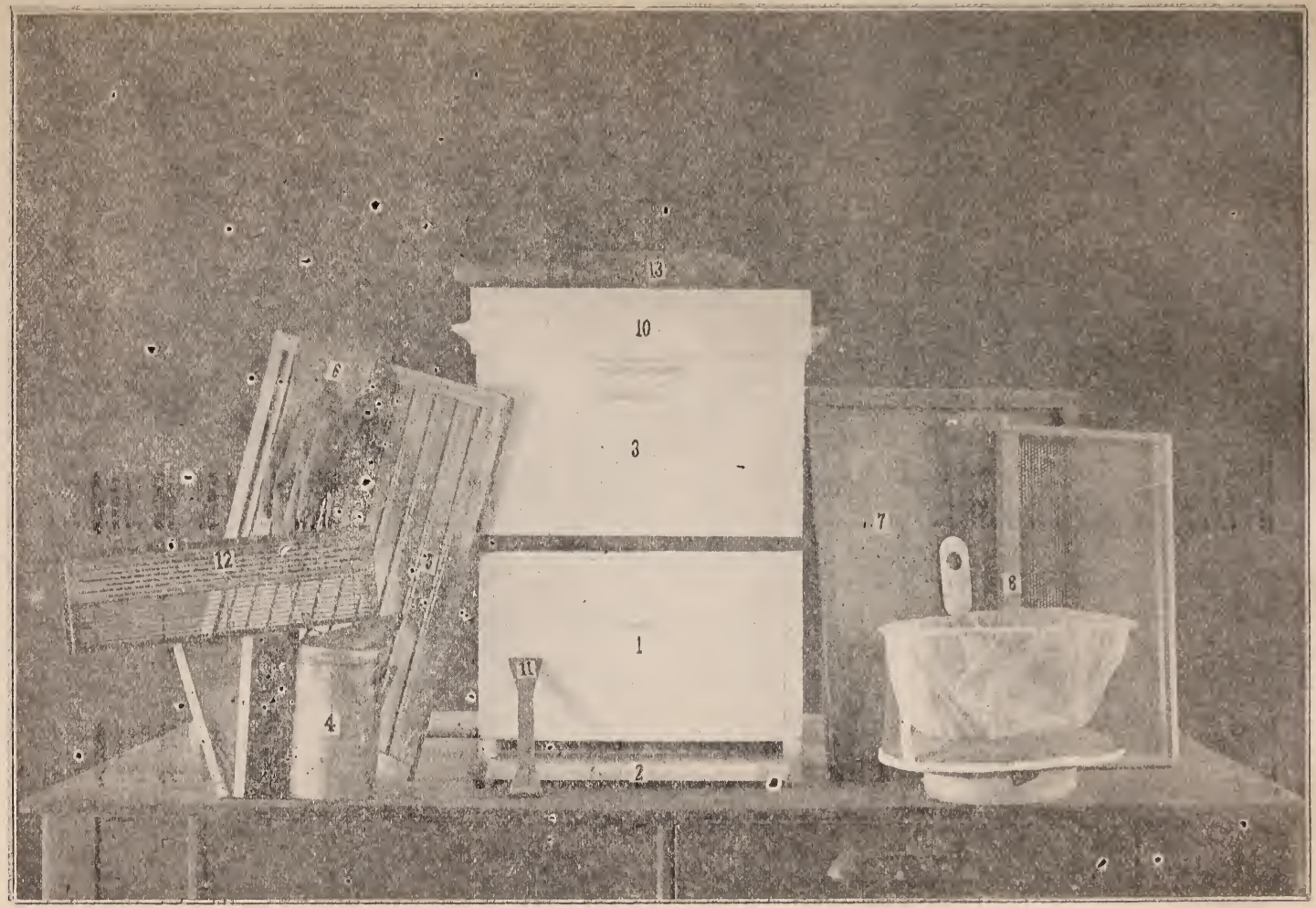

HIVE AND EQUIPMENT.

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BEE KEEPING IN PORTO RICO.

INTRODUCTION.

At the present time the honey industry of Porto Rico is in its infancy. There are a few apiaries on the island, located in the mountainous district of Ponce and in Mayaguez; a few others are scattered over the island, but there is no area which could be considered over-stocked. There are extensive acreages where Italian bees cannot be found. Native hives have been used, but now some of the bee-keepers are transferring their stock to the standard hive and are raising Italian bees.

The northern, western, eastern, and interior portions of the island are exceptionally well adapted to the bee industry, while the south side is not considered so good on account of the scarcity of rain during all seasons of the year. The bees at the experiment station have never had to be fed during the winter months of the year. This year two hives of Italian bees have been weighed morning and evening, one from December 13th until February 13th, showing an increase in weight of fifty-five pounds, while the second showed an increase of forty-nine pounds, from December 22nd to February 12th. This was during the driest months of the year.

Very little, if any, modern writings in Spanish can be found on bee culture. Owing to the increasing interest in this subject and the many inquiries about it, which are constantly being made, it has seemed advisable to issue this circular, which seeks to bring together the various subjects on bee culture that will be helpful and instructive to beginners in the handling and establishing of small apiaries in the Tropics. There is also given a list of some of the more important honey plants in Porto Rico.

The coffee planters particularly have become interested in the raising of bees, not only for the honey but because bees are very useful in pollenizing coffee in seasons when there is a great amount of rain during bloom. The pollen in the coffee is carried by the winds from flower to flower, but, if there is much rain, very little bloom is set as only the dry pollen is carried by the wind; during rainy periods the bees visit the flowers and distribute the pollen in their honey gathering. Coffee plantations also afford excellent fields for bees to work in as honey is obtained from the coffee shade as well as from the coffee itself.

It will undoubtedly be more profitable and practical for our

apiarists to produce extracted honey, as it is very doubtful if comb honey in one pound boxes could be shipped with safety.

Comb honey can be produced for home consumption, but beginners will find it much easier to produce extracted honey.

The production of extracted honey is not only easier for the bee-keeper, but is much less work for the bees, than is the raising of honey in one pound sections.

In making the extracted honey the comb is used over and over again by the bees instead of their having to build new ones each time, as is the case in making the pound sections. When the comb in the supers is filled with honey and well capped it is taken to the extracting house, uncapped, and the honey removed by the extractor. The empty comb is then given back to the bees for them to re-fill with honey, thus saving bees the labor of producing new wax.

It is much easier to control the bees when extracted honey is raised, as there is less tendency on their part to swarm. Honey is raised in larger frames and the bees are not forced to so great an extent as in the production of comb honey made in small sections. Bees will not start to fill the one pound sections until they have filled every available cell in the brood chamber. This cramping of the brood starts the swarming fever; if they are not watched very little honey is produced in the section boxes and a swarm comes off, lessening the working force of the hive. This is not the case in the production of extracted honey, for, as soon as there is a flow, supers are added, provided the colony is strong and shows a tendency to store.

It has been found that it takes from 10 to 20 pounds of honey to produce a pound of wax under ordinary conditions, but when shook swarming is practised, wax can be produced with a considerable smaller amount of honey. When honey is worth from 4½ to 7 cents a pound it is more profitable to produce it than wax at 25 to 30 cents a pound.

In countries where the bees gather honey dew, which is a secretion given off by insects, it is more profitable to feed this class of honey back to the bees and produce wax, but here we do not have these conditions as all our honey is obtained from flowers.

Bee books, magazines, and circulars, are of great assistance to the biginner and many valuable points may be obtained from them, but the best teacher is actual experience in handling bees. It is, therefore, advised that those who wish to take up bee culture, commence in a very small way, with from one to four hives, and study the ways and habits of these interesting little insects and learn to handle them intelligently before increasing his stock.

LOCATION OF APIARY.

The apiary should be in a locality where there is an abundance of bloom, and, if possible, near a good road so that the honey may be easily shipped to market. After selecting a general location the site for the apiary may be chosen. The hives

should be situated so that they will get the morning sun. They should be arranged on good stands several inches off the ground so that the soil will have a chance to dry under them and also as a protection against ants. Shelter should be provided so that the hives will not be in the direct rays of the sun during the middle of the day. The early morning and late afternoon sun does not heat the hives overmuch. On coffee plantations during the crop labor is usually short so all work with the bees has to be done in the afternoon when it is raining. In such cases it is very necessary that the hives are under a shelter. On most estates there are old buildings or sheds not in use that may be devoted to bees, if not, sheds may be made, thatching the roof with grass, cane tops, or yaguas (leaves) of the royal palm.

If hives are left in the open they should be covered with sheets of tin or yaguas. The apiary should not be too near public highways or dwellings, as bees sometimes become a nuisance to the neighborhood, but they should be near enough to the keeper's house to enable him to hear them whem they swarm.

APPARATUS.

HIVE STANDS.

In all countries it is advisable to have the hives raised from the ground, but in the Tropics it is particularly necessary on account of the excessive rains during certain parts of the year. Stands may be made of boards, brick, or stone, so arranged as to make a good firm foundation which cannot easily be upset. Some bee-keepers on the island have made stands of cement and rock, making a solid bed large enough for two colonies. These solid stands are especially good where ants are troublesome.

HIVES.

All parts of the hive including the cover, bottom-board, supers, frames and division boards, should be made of the best well-seasoned wood. There are a number of hives on the market, but the standard hive for extracted honey has ten frames and is considered by bee-keepers to be superior to the eight-frame hive especially in the Tropics. They allow the queen to produce more brood and at the same time, when the flow of honey is at its height, the brood chamber is not filled with honey so that the queen is cramped and the bees develop the swarming fever.

Supers are used for the storing of surplus honey and are of the same basal dimensions as the hive body on which they are to fit. The number of supers used depend on the length of the honey flow. It is the general practice to space the frames so that each super will contain nine frames. When nine frames are used in a super the bees make thicker comb than when ten frames are used. The thicker combs are much more easily uncapped, as the honey extends beyond the sides of the frames.

Supers are placed on the hives when the brood chamber is full

of bees, larvae, and eggs. When this stage is reached the bees pull out the honey cells at the top of the comb just below the frame bars. The whitening of the comb may be taken as a sign that the bees are over-crowded and supers are needed.

The hive boxes and supers are rabbeted at the ends so that the frames hang, leaving a bee space at the top, sides and bottom. Both supers, and hives, have handhole cleats which aid materially in lifting full boxes. The dimensions of the standard frame are nine and one-eighth inches by seventeen and five-eighths inches; the frame bar is eighteen and seven-eighths inches. Frames are so made that a piece of artificial comb starter may be inserted in the underside of the frame bar. This piece of starter is to guide the bees in making good, straight comb. The frames are also wired to prevent the comb from breaking down. New super comb often breaks in the extractor if it is not wired.

Great care should be exercised in the spacing of frames in the brood chamber. They should be spaced equally so that the bees will make all the brood of uniform thickness. The frames for the standard hives are made to fit exactly so that there is no chance for unequal spaces. There should be one and three-eighths inches distance from the center of one frame to the center of the next.

Movable frames are used now-a-days by all up to date bee-keepers. They enable the bee-keeper to examine the brood and carry on a number of operations which are essential in successful bee-keeping. These operations are fully explained in another part of this circular.

If frames are not used and bees are kept in boxes the amount of honey raised is small and every time honey is removed the bees have to be smoked out or destroyed. The honey obtained in this way is of an inferior quality.

Hive boxes should be painted with a good white lead paint before putting them together and when this begins to wear off they should be painted again to preserve them. This should not be neglected, especially in this climate as the boxes are liable to warp when exposed to the sun and rain.

HONEY BOARDS AND QUEEN-EXCLUDERS.

Honey boards are used to prevent the passing of queen and drones from the brood chamber to the supers. With one of these boards on a hive the brood is confined to the lower box and nothing but honey is stored in the super. There are a number of different kinds of honey boards made. The kind most generally used is made of perforated zinc. Some are bound with wood and some are left plain. Those bound have thin strips of wood over the zinc which cover some of the perforations. The strips of wood are so spaced that they come over the frame bars, and the spaces with the perforations come directly above the open spaces between the frames, thus giving the bees ample room to pass up and down. This style of board rests between the super and the brood chamber, having the same dimensions, thus a bee space is

left between the hive and the honey board. The unbound honey boards are made to fit down on the frames thus leaving the bees with fewer perforations to pass through to the super. Another type of honey board is made with a series of wires which are spaced so that worker bees can pass between them. This type is claimed to be superior as it does not have any rough edges, the wire being round.

BEE ESCAPES.

Bee escapes are used for removing bees from full supers or comb boxes. They are very essential to the apiarist, saving a great deal of time, also preventing stinging. This little contrivance is made so that the bees pass out between two delicate springs, which does not permit them to return. One of these escapes is usually placed in a board and then inserted between the super and the brood chamber. They are generally put on the hive late in the afternoon and by the next morning most of the bees have passed down through the escape. A little smoke blown under the cover will hasten the passage of the bees downward, thus the box of honey can be removed without having to brush the bees from the comb. Supers should be removed soon after the bees leave as there is no ventilation and there is danger of the comb melting, if the hives are in direct rays of the sun. If supers are left too long on the hives ants are apt to enter them. These boxes of honey should be taken at once to the extracting room.

DRONE TRAPS.

Drone traps are used for catching undesirable black drones. It is a two compartment contrivance, the front and top being made of perforated zinc and wire so spaced that the drones cannot pass out between the spaces. The trap is made the exact width of the hive entrance; the drones being unable to escape through the wires in the lower compartment pass upward through two cones of wire netting into the upper compartment. This is also covered with perforated zinc through which they cannot escape but there die of starvation. The worker bees, heavily loaded with honey and pollen, can pass through the wire spaces and also through the perforated zinc which covers the top compartment, so their work is not stopped.

These traps may also be used for the catching of queens at swarming. When a swarm issues with a drone trap at its entrance the queen can not join the swarm. She generally crawls into the upper compartment and there remains. The bees go out and fly for a time, but, when they discover that their queen is not with them, will return to the hive. A new hive may then be placed on the old stand, and as the bees return and enter the hive the trap is opened and the queen is allowed to run in with the bees. The new hive is then removed and the old one put back on the original stand. If the old hive is not put back the new hive can be given the old supers and the bees allowed to work with them.

The workers from the old hive, which has been placed on a new stand, will go to the fields and then return to the old stand, thus increasing the working force of the swarm. The old hive will raise a new queen and in time it will become a strong colony. If new colonies are not desired the bees which hatch from the brood may be given to the swarm and at the end of three weeks the old hive may be broken up, giving the frames to other colonies.

DIVISION BOARDS.

When one is building up a hive from a nucleus and there are only a few frames of bees in the hive, the frames are set against one side of the hive and the other side is protected by a division board. This board keeps the heat around the frames and the bees do not have to maintain a uniform temperature in the part of the hive not occupied by them. They are also used in nuclei and in supers when all the space is not occupied with frames.

VEILS AND GLOVES.

All beginners in bee culture should provide themselves with a smoker, bee veil, and gloves. After one becomes familiar with the habits of bees they are not always needed, but when bees are cross they are very necessary.

A good sized smoker that does not have to be filled often is the most satisfactory. The writer has found that the dry wood of the guamá lights readily and gives plenty of smoke. Old rags, tobacco, and dry banana leaves may be used, but the dry guamá wood seems to be the best.

There are many bee veils on the market that afford excellent protection. The facial portions should be made of black or green material as they are much easier to see through and are not so trying to the eyes. A home made veil, which has given great satisfaction, can be made similar to some on the market, but for every day use it lacks some qualities which the others possess. The veil may be attached to an ordinary straw hat with a two and one-half to three and one-half inch brim. A piece of green or black wire screening about ten inches wide is sewed on the brim of the hat. Green screening is better as this color is not as hard on the eyes. The wire screening is cut one half inch longer than the circumference of the hat so that it may be lapped and sewed together at the back of the hat; the lower portion of the wire is then bound with a piece of cloth on which is sewed a piece of cotton netting. The cotton net should be cut a foot deep and in the lower edge fitted with a draw string so that when the bee veil is placed on the head the net may be gathered under the collar. The outer edge of the hat may also be bound with cloth and to it sewed the upper edge of the wire screening. These veils are very cool and the wire screening is easily seen through on account of its dark color. Another advantage of the wire over a cotton veil is that it is stiff and always stands out from the face, giving better protection.

MANIPULATION AND BEHAVIOR OF BEES.

When opening a hive a few puffs of smoke should be blown into the entrance and as soon as the cover has been removed a little smoke should be blown into the hive to force the bees down on to the frames. The smoke disturbs the bees and they fill themselves with honey. Bees filled with honey are much more docile and are less apt to sting, which makes them easier to handle. While the bees are filling themselves with honey the bee keeper may clean the tops of the frames if they are covered with superfluous wax or propolis. A very handy implement for this work is a putty knife; it can also be used in spacing and in separating frames so that they may be taken out without injuring the bees. Great care should be taken when lifting out frames so as not to crush a single bee. When bees are crushed a small amount of formic acid is set free and the odor of this creates a desire amo g them to sting. The formic acid is stored in a minute sack with connects which the sting.

Great care should be taken also, not to injure the queen and upon taking out frames one should look at once to see if she is present. The most convenient way to remove a frame of bees is to take it with both hands, one at each end of the frame, lifting if carefully, always keeping it in a vertical position. When it is well out of the hive, raise it to a position on a level with the eyes, holding the frame between the thumb and fingers. Either raise the right or left hand until the frame is in a vertical position the long way; then, by twirling the frame to the right or left, either side of it may be examined withe ease. By keeping the frame in a vertical position none of the uncapped honey is spilt. If honey is allowed to drip over the frames or on the outside of the hives it is liable to cause robbing, especially during seasons when little honey is being gathered. Frames should always be held over the hives to prevent bees or queen from falling to the ground and being lost. When a frame is taken out of the hive and has been examined it may be rested against the side of the box in as near an upright position as possible so that the honey will not leak out. Frames of brood on which the queen is crawling should not be set on the ground along side the hive as she is liable to be lost in the grass, especially if she has her wings clipped as she whould be unable to fly back into the hive.

The queen is generally found on the center frames of the hive. If the bees are not disturbed to any great extent she may be found quietly crawling over the surface of the comb in search of empty cells in which to deposit her eggs.

VARIETY OF CELLS.

Three kinds of cells are always found in the brood frames and when queens are being raised there are four. The first cells below the frame bar are for the storing of honey and are inclined upwards so that it will not run out. In a strong colony there are very few honey cells as most of the space in the

frames is taken up by brood. Below the honey cells there are a few cells mixed in with the brood in which pollen is stored. The nurse bees use this pollen as food for the brood.

Brood is composed of two kinds of cells, worker and drone. The center part of frames of brood is composed of worker cells. As soon as the young bees come forth they act as nurses for the new brood. The cells they occupied are again filled with eggs by the queen. These hatch in three days, and for the first three days the larvae are fed on honey and pollen which has been predigested by the nurse bees; this predigested food is called royal jelly. The next two days they are fed on honey and pollen. The cells are then capped over and the larvae changes to a chrysalis. At the end of thirteen days the adult worker comes forth. The development of the worker bee covers a period of twenty-one days.

Drone cells are much larger than worker cells. They are few in number and are generally present at swarming times and when queens are being raised. These cells are usually found in the lower corners of the brood. It takes three days for the eggs to hatch and for the next three days the larvae are fed on royal jelly. For three days more they are fed on honey and pollen. After this the cells are capped and the adult drones or males come forth in fifteen days. It is twenty-four days from the time the egg is laid until the adult drone comes forth. Male bees, or drones do not work but are very important members of a colony as their purpose in life is to fertilize the young queens. A few drones can generally be found in a strong colony at all times, but during swarming they are more numerous

The bees generally select frames from the center of the hive in which to produce queen cells. They choose these frames because they are the warmest part of the hive. These cells are usually found at the bottom of the combs or on the lower three-fourths of it. As the queen cells are much larger than the worker cells the bees have to use the space of three cells. They remove the partitions between the center one and the two outside ones. The eggs or larvae in the two outside cells are destroyed, leaving only the egg or larvae in the center cells. The space of the three cells is devoted to the raising of the larvae which is to produce the queen bee. The eggs hatch in three days. The larvae are then fed for five and one-half days on royal jelly; the cell is then sealed and the larvae continues to feed on the royal jelly which has been stored in its cell. At the end of seven days the young queen comes forth. The time required for the development of a queen from egg to adult is fifteen and one-half days. Virgin queens remain in the hive from five to ten days and then go forth on their virgin flight and return fertilized for life. She generally commences to lay in four or five days.

The queen has the power to lay either a fertilized or an unfertilized egg. Unfertilized eggs produce drones and the fertilized eggs produce workers, but if a fertilized egg is fed upon royal jelly through all its larval stages it will produce a queen. All

eggs hatch in three days and all larvae are fed for three days on royal jelly. Queen larvae are fed on royal jelly for 5½ days.

Wax is used for making comb and also for capping honey and closing up small openings into the hive. For this work it is generally combined with propolis. Propolis is a gum obtained from flower buds. Wax is secreted by the bees from eight small openings, four on each side of the abdomen. Each piece of wax is very small and is deposited by the bee in position for the making of the cells. When cells are being made the bees attach themselves to the frame bar or to the new comb and build down. They cling to one another, forming long chains. Those bees producing wax are constantly moving up, crawling over the other wax producers, thus a continuous movement is kept up.

PREPARING HIVES FOR THE HONEY CROP.

Tropical conditions for bee keeping are different from those in the temperate zone. In the North the bee keeper has certain seasons when his bees are not active; during the winter months the bees are in winter quarters and at this time they are consuming honey. When the spring opens the bees come out and at once commence to gather honey and pollen to raise brood. This new brood is to produce the bees which are to raise more brood and to gather the surplus for the coming season. Many times in the early spring there is very little honey and pollen for the bees and the bee keeper has to stimulate brood raising by feeding. Here we have to keep our brood chamber always full of bees so as to be ready for a flow of honey. There are a number of heavy flows, but they do not come on at fixed times. Thus spring management should be kept up all the year. After any heavy flow of honey the brood chamber should be looked over and if the outside frames are full they should be taken out and placed in the supers, or, if the frames are built up with worker cells filled with honey, they may be uncapped, the honey extracted and then returned to the brood chamber for the queen to lay in, thus giving the same amount of space for the queen as she had previous to the flow. If the frames full of honey are placed directly into the super from the brood chamber, empty frames with full foundations, or frames with starters, may be put in their place, thus keeping up the laying space for the queen.

SWARMING.

In northern countries swarms come off in the spring, but they may occur here at any season of the year.

Swarming is often caused by the over-crowding of the brood chamber by the worker bees in their haste to store honey. They fill all the brood cells which cramps the queen and she at once starts the swarming fever. This may be prevented if the bee-keeper will supply his colonies with supers in which the bees may store their surplus. If the bees do not seem inclined to store honey in the supers they may be encouraged to do so by placing a partially filled frame of honey in the super. This frame is taken from the brood chamber below.

The outer frames in the brood chamber are often composed of solid sheets of honey without brood, but if this is not the case an uncapped frame of brood may be used, making sure that the queen is not taken up with it. The placing of empty frames in the brood has a tendency to discourage swarming. When the swarming fever has not been suppressed and queen cells are started in the hive and are capped over, which takes about eight and one-half days after eggs are laid, the old queen goes out with all the working bees of the hive making a swarm. Queens do not always swarm out when the new queen cells are first capped, but often wait until the new queen appears. To prevent swarming during the heavy flow some bee keepers look over the brood chamber every eight or ten days, cutting out the queen cells. This takes a great deal of time and even then some cells are apt to be overlooked and a swarm comes off.

Swarming generally occurs in the morning from nine until twelve. If, however, the morning is cloudy and there are indications of rain, swarms which would naturally occur then, do not come off until afternoon. Swarms that come off at this time generally cluster and remain until the next morning. When such clusters are found they should be handled with great care as the bees have used up all their honey during the night and are not docile but sting at the least provocation.

After once hearing the noise made by bees swarming one will never mistake it. The bees, if it is a large swarm, seem to boil out of the entrance of the hive. They remain in flight around the hive until the queen and all the swarm bees are out of it. After a few minutes flight the queen settles on some object and the bees cluster about her. They remain there until the scout bees return and in their bee language tell their fellow workers they have found a suitable place in which to establish their new colony. The bees often cluster on trees, remaining at least two hours before flying away. If the bees have started to work before the return of the scouts they will not go to the home recommended by the scouts. It is almost impossible to stop a swarm of bees in flight after the scouts have returned. Before bees swarm they fill themselves with sufficient honey to feed upon until they find their new home, and also for use in constructing the new comb. If one has been fortunate in hiving the swarm, the bees under normal conditions begin at once to make wax to build their comb. Often swarms, after being hived, will not remain in the hive but will swarm again. To prevent this it is advisable to give them a frame of uncapped brood. If this is done bees seldom swarm a second time. The first swarm goes out with the old queen, generally when the queen cells are capped over. The second swarms occur when the virgin queens come out. Sometimes there are two or three after-swarms, according to the strength of the colony. It is not a good practice to allow these after-swarms, as they are called, as they weaken the colony and as after—swarms are small in takes a long time for them to develop into good, strong

colonies. After-swarms can be prevented by destroying all queen cells but one after the first swarm comes off. If nothing but extracted honey is produced, as has been recommended, we can eliminate the swarming fever to a certain extent by breeding from hives that show no great tendency to swarm. This will not only save the apiarist a great deal of labor but more honey will be produced. It will also obviate the necessary practice of shook swarming and the removing of brood. It might be added here that it is a good plan to plant a number of low growing trees around the apiary. This not only affords a place for the bees to swarm it but it also acts as a wind-break.

HIVING OF SWARMS.

There are a number of appliances for catching swarms and some of them are a great help, especially in removing clusters of bees from high trees.

After hiving a swarm it is a good practice to place it on what is to be its permanent stand. It may be left, however, for a few days and then moved, but this is not a very good practice as the bees have to be shut up and then moved which means a loss of time. If no extra precautions are taken in obstructing the opening of the hive, the bees will come out and in their great haste to gather honey will not notice that their surroundings are different, and after gathering their honey in the field will return to the place where the swarm was first hived and there die or enter other hives. In hiving a swarm the bee-keeper many times wishes to know if he has the queen in the cluster. To accomplish this cut down the swarm and shake it upon a piece of cloth which has been spread in front of the entrance to the hive in which the swarm is to be placed. The queen may then be easily seen entering the hive with the bees. If, by any chance, there are two queens in the swarm one may be destroyed; or, if both queens are to be saved, another hive may be placed near and one of the queens with part of the bees directed into it. Often times two swarms come out at the same time and form one large cluster. With the above method both queens are saved, otherwise one of the queens might swarm out with a cluster of bees after the apiarist has left them, thinking everything is all right.

When a swarm has been hived the hive should be shaded from the sun by a piece of tin, boards, or royal palm leaf (yaguas) so that it will not be too warm and cause the bees to swarm out. It is a good practice to place in the hive in which the swarm is to be hived, a frame of uncapped brood. When this is given to a new swarm they very seldom desert the hive into which they have been placed.

SHOOK SWARMING.

When it is found that bees are starting queen cells during a heavy flow of honey swarming is prevented by a practice known as "shook swarming" which is accomplished in the following manner. Shake most of the bees from the brood into a new hive

which has been placed on the old stand. In the box place either full frames of foundation or pieces of foundation as starters. If the original hives had supers on it these may be given to the shook swarm. Some bee-keepers consider it best to give the bees only starters, hence they store honey in the supers. Under these conditions the queen has only a small number of cells in which to lay and there is no possibility of a second swarm. If bees will not accept these quarters they may be induced to remain in the hive by supplying them with a frame of uncapped brood. This artificial swarming is often practised when comb honey is being produced. The old brood chamber may be broken up and given to nuclei or it may be left to develop a queen.

CLIPPING OF QUEENS.

Some bee-keepers practise the clipping of queen wings. This is done for two reasons,—to tell the age of queens and to prevent the queen from flying away with the swarm. As soon as a queen returns from her virgin flight and begins to lay eggs, one of her wings is clipped and a record made of it. At the end of a year another wing is clipped and so on, each clipped wing indicating a year of age. Thus one can tell the age of a queen at a glance. By using such a method it is easily seen whether the old queen has been superseded by one of her daughters. If there is no distinguishing mark on the old queen, such as a clipped wing, it is impossible to tell if she has been replaced by a young queen. When a swarm comes off with a clipped queen the bees fly away from the hive and circle, waiting for the queen to join them, or to alight so that they may cluster around her; if she has clipped wings she cannot fly and the bees return to the stand. If the queen is found by the apiarist and she is put in a conspicuous place where the bees can see her, they will cluster around her and the swarm is then hived, or she may be caged and given to a queenless colony in which case the bees will return to the old stand. To prevent a second swarming from the old hive all the queen cells but one should be destroyed.

BREEDING QUEENS.

Good breeding queens are those which produce the greatest number of bees, which in turn, produce the greatest amount of honey. In selecting a good breeding queen there are a number of points to be considered. Do their bees produce a surplus of honey? Are they hard to handle? Do they sting readily? Have they good color? Generally speaking bees with plenty of yellow are good workers. After deciding upon a good breeding queen she may be taken away from her colony leaving it queenless. This will force the bees to make queen cells. If one does not wish to use his strongest colony for the production of queen cells he may select a frame containing young larvae and eggs from this colony. This frame is then given to another queenless colony. The queen cells which develop on the other frames are

destroyed leaving only the queen cells on the selected frame to develop. It is best to use frames of brood containing larvae two or three days old, as the bees will select larvae in preference to eggs from which to raise their queens, thus saving them from three to five days. When introduced frames are given to colonies they should be marked so that the queen cells will not be destroyed when the beekeeper is cutting out the other queen cells in the colony into which the selected brood has been introduced. When the cells are capped over the frames can be removed from the brood chamber and placed in the supers provided there are plenty of bees to keep the cells warm so that the young queens will not be retarded in their growth. Then their old queen may be introduced into the brood chamber provided there is a queen excluder between it and the super. If no excluder is used the queen will go up into the super and destroy all the cells. A few days before the young queens are to come forth they must be caged, for if one of them should hatch she would at once kill all the others. The young virgin queens are then given to queenless colonies or to nuclei.

Many beginners in apiculture increase the number of colonies too rapidly the first year, which is a mistake. It only weakens the colonies, the brood is poor, and the queens raised are undesirable. It is best to obtain the first increase by natural swarming, or by raising queen cells from the best, and strongest colonies, giving these queen cells to nuclei prepared from other colonies. Another mistake often made is the raising of queen cells in nuclei. This should not be practised as queens raised in this way are inferior to those raised at swarming time or in strong queenless colonies. Nuclei do not have the strong queen raising inclination as do colonies, thus the queens raised are small. Small queens, as a rule, do not live as long and do not have the laying capacity of large queens. The amount of honey produced by a hive depends primarily upon the laying capacity of the queen; therefore, they should be bred from colonies which produce the most honey. Most any queen will produce a box of bees, but not every queen will raise sufficient bees to produce a surplus of honey, which is the apiarist's profit.

The increase of colonies by artificial means may be practised in this climate to a far greater extent than in countries where the bees have to lay up a surplus for the winter months. Even under our conditions, however, one should be careful not to take away too much brood from the queen at any one time, to make nuclei, thus reducing the brood comb and cramping the queen. If this is done often it tends to discourage queens.

Some bee-keepers have been troubled because their queens would not lay. This is probably caused by too much black blood in the colony. It has been observed that it is very difficult to obtain much honey from a colony which has a black queen whose mother was also black and which had swarmed out leaving her as the queen of the old hive. The first and second crosses of black bees with Italians are very good workers and produce an abundance of brood

and honey. The great objection to them is that they develop an excess of drones and these cross-bred drones are not wanted in the apiary as they will eventually bring down the stock. Only drones from the best hives should be left to fly, all others may be caught in drone traps and destroyed.

INTRODUCTION OF QUEEN CELLS AND QUEENS INTO COLONIES AND NUCLEI.

In Porto Rico honey is produced at all seasons of the year. In the past two years the writer has observed that there were only a few short periods when the bees did not seem to be storing a surplus. With these conditions one has to have a knowledge of what is taking place in the hives at all times. Our flows of honey may not be as long as some of the honey flows in colder countries, but there are certain seasons of the year when the flow is as heavy. Working under these conditions we must see to it that the brood chamber does not become overcrowded with honey, that the queens do not stop laying thus crippling the brood. Another point which should be looked into is the replacing of old or undesirable queens. It has been noticed by some of our beekeepers that the queens have a tendency to stop laying, thus lessening the brood. In the writer's opinion queens have to be replaced much oftener in Porto Rico than in northern countries, as they are called upon to lay all months of the year and are worn out in a much shorter time than if they had a rest of four or five months. At the experiment station it has been noticed that queens having a considerable amount of black blood show a greater tendency to cease laying than do pure Italian queens.

When the colony becomes queenlees the bees at once start to produce a new queen. Often a bee-keeper does not wish to wait until a colony can raise its own queen, as it takes about three weeks before the new queen would begin to lay. He, therefore, introduces a queen cell, virgin queen, or laying queen. In nature queen cells are only produced at swarming times when the brood becomes over-crowded or when the hive becomes queenless. Hives become queenless for various reasons. The queen may be killed by being crushed between two frames of brood when manipulating them, or she may be killed by the bees themselves, or she may die a natural death.

When one wishes to increase the number of hives by artificial means he takes one of the capped queen cells and gives it to a nucleus which has already been queenless one or two days. Queen cells are placed in the nucleus in a number of different ways. One of the center frames is taken out and a hole is cut into the size of the piece of comb with the queen cell attached. The queen cell is then inserted into the hole and pinned in place with small pins or bits of wood. If the nucleus has been queenless for a few days the bees readily accept this new queen cell. Generally when a colony has been queenless for three or four days, the bees commence to prepare queen cells, but they are usually small and not

considered as good as queen cells prepared in a strong colony. For this reason a nucleus should not be allowed to produce its own queen. It is best, however, to allow the queen cells which are started by the nucleus to develop, and as the queen cell which is introduced will have been capped over for three or four days before its introduction this queen will appear before the other cells mature. When she comes forth she will destroy the other cells. When one does not wish to insert the queen cell in a frame of brood it may be placed between the two central frames, suspended by a small wire hanging in a vertical position. Often bees will refuse to accept inserted cells and will destroy them by cutting into the sides of the same. When the queen comes forth of her own accord she always cuts off the tip of the cell leaving a small, round opening. This enables one to determine whether she has been destroyed or whether she has come out of her own accord. Queen cells are introduced into colonies in the same manner.

Queens from nuclei are introduced into other nuclei or colonies in the following manner: Sometimes mature queens are allowed to run in at the entrance of a queenless hive and the bees accept her at once, but this is not usually the case, as bees do not readily accept a foreign queen. Sometimes bees will accept a queen if she is placed on top of the frames and allowed to run down among them. The safest way, however, of introducing a mature queen is by means of a small queen cage. These cages are made of wire. They are about two and one-half to three inches long, one and one-quarter inches wide, and about one quarter to three-eighths of an inch thick At one end of the cage a piece of wood is inserted and at the other end there are two small pieces of wood, one on either side, between which the queen may pass into the hive. Into this space is placed a little honey and sugar made into a thick paste. This is packed firmly into the opening so that it will take the bees a number of hours to remove it, and thus liberate the queen. During this time the queen takes up the odor of the surrounding bees and is generally accepted without being bothered by them. It is a advisable to look into the hive to see if the bees are feeding the queen through the wire meshes of the cage; if they are feeding her, it is a good sign that she will be accepted by the colony. If the bees are tryingto sting her, more honeed and sugar should be placed in the opening, thus detaining the queen for a longer time. Very often a queen has to be confined in a cage a number of days before she will be accepted by the colony.

Often when a young queen is introduced into a nucleus and precautions are not taken, the bees pounce upon her and try to kill her. This is called «balling». Virgin queens, when introduced into queenless colonies, are often killed in the same manner. Virgin queens should be introduced into nuclei or queenless colonies not later than twenty-four hours after they come forth, as the bees are more apt to reject them after that time.

PREPARATION FOR MAKING NUCLEI.

Nuclei are used to increase the number of colonies, or for developing queens which are afterwards introduced into other colonies after they have mated with the drones. Nuclei can be made of any number of frames. There are one, two, three, and even five framed nuclei. Strong three framed nuclei are generally used for developing queens. When a nucleus is to be started the apiarist selects full frames of well capped brood which is about ready to hatch. The reason for using brood of this kind is, that if the old bees should return to their former hive there would soon be young bees to take their place. The frames with the adhering bees are put into a hive or box. The entrance is closed and they are taken to their new stand. It is a good practice to keep the bees shut up for a day or two so that they will become accustomed to their new home. A small board or a branch with a few leaves on it should be placed in front of the entrance to hinder the bees as they rush out of the hive. Upon meeting these obstacles they will stop and note their surrounding so that they will be able to locate their new hive when they return from gathering honey. If nothing has been placed before the entrance of the hive to attract their attention the bees will rush out and fly to the fields and return to their old stand, thus weakening the nucleus.

Queen cells from other colonies may be introduced by methods described previously, or queens may be given to nuclei as before stated. As soon as the bees come forth from the brood and the nucleus is strong it may be given frames for the bees to work upon from time to time. The nucleus will finally become a strong colony. If one wishes to build up the nucleus quickly, full sheets of foundation may be given, thus saving the bees a great deal of time. If at any time, a nucleus is made with one or two frames of brood and the bees are few in number, full frames of capped brood, from which young bees are coming forth, may be given, thus building up the strength of the nucleus in a very short time. If the apiarist wsihes to use the nuclei only for the raising of queens, they may be divided at any time and returned to strong colonies. When a nucleus is divided and returned to strong colonies, it is a good practice to smoke the bees in the nucleus and also those in the colony in which it is to be inserted. This is done so that the bees from the nucleus will not be destroyed by the colonies in which they are placed. Smoke takes away the odor of the bees.

UNITING.

The uniting of colonies or nuclei has to be resorted to sometimes. Colonies may lose their queen when no queen cells are ready to give to them, or a colony may be too weak to raise a queen, or, if it has been without a queen for some time it very likely would not accept a new queen if supplied with one. Under these conditions, it is often best to unite a queenless colony or nucleus with one which has a good queen. A queenless colony

that is diseased should never be added to a healthy one, but it should be destroyed. Uniting is accomplished in the following manner: Each colony of bees has its own peculiar odor so that when a strange bee enters the hive it is recognized as a foreigner on account of its different odor, and it is considered a robber by the guards at the entrance. For this reason it is necessary to destroy the odor of colonies before uniting them; this is accomplished by giving each a good smoking. If the colonies to be united are on stands near one another, it is a good practice to gradually bring them closer together by moving them a little nearer every day until they are very close to one another. Bees have a perfect knowledge of the location of their home and if the hive is moved any distance, say one or two feet, the bees are not slow in recognizing the change. When the bees returning from the field discover that their home has been moved they fly to the space where the old hive stood and then circle about until they recognize their old hive in its new position and enter hesitatingly. For this reason after uniting two colonies, or nuclei, a small piece of wood or a few leaves should be placed in front of the entrance. This is to act as an obstacle to attract their attention to the position of their new quarter. It should be noted that bees returning with a full store of honey are generally admitted into other hives than their own and are not considered robbers. When two weak colonies are united it is well to cage the queen for to or th ee days so that she will not be destroyed by the foreign members introduced.

FEEDING BEES.

In Porto Rico, as far as the writer knows, bees have never had to be fed. If bees were kept on the south coast, however, it might be necessary to feed them during seasons of long droughth. The following extract on feeding bees taken from Farmer's Bulletin 397, United States Department of Agriculture, is of interest on the subject:

"..... .....Honey from an unknown source should never be used, for fear of introducing disease, and sirup made of granulated sugar is cheapest and best for this purpose. The cheaper grades of sugar or molasses should never be used for winter stores. The proportion of sugar to water depends on the season and the purpose of the feeding. For stimulation a proportion of one-fourth to one-third sugar by volume is enough, and for fall feeding, especially if rather late, a solution containing as much as it will hold when cold is best. There seems to be little advantage in boiling the sirup. Tartaric acid in small quantity may be added for the purpose of changing part of the cane sugar to invert sugar, thus retarding granulation. The medication of sirup as a preventive or cure of brood disease is often practised, but it has not been shown that such a procedure is of any value. If honey is fed, it should be diluted somewhat, the amount of dilution depending on the season. If robbing is likely to occur feeding should be done in the evening.

Numerous feeders are on the market, adapted for different purposes and methods of manipulation. A simple feeder can be made of a tin pan filled with excelsior or shavings. This is filled with sirup and placed on top of the frames in a super or hive body. It is advisable to lean pieces of wood on the pan as runways for the bees, and to attract them first to the sirup, either by mixing in a little honey or by spilling a little sirup over the frames and

sticks. It may be stated positively, that it does not pay financially, or in any other way, to feed sugar sirup to be stored in sections and sold as comb honey. Of course, such things have been tried but the consumption of sugar during the storing makes the cost greater than the value of pure floral honey."

HANDLING OF HONEY

EXTRACTING HOUSE

There are a number of things to be considered in building an extracting house. First, its location; the house should be within a reasonable distance of the apiary so that the boxes of honey to be extracted will not have to be carried too far, as a full super of eight to ten frames weighs from seventy-five to ninety pounds. If they have to be carried very far it means a considerable amount of labor. Precaution must be taken, however, not to have the house too near the hives as the bees will be attracted by the odor of the honey and become bothersome. If honey were always extracted during a flow, the house might be close to the apiary, but this is not always the case as the apiarist often waits until after the flow is over before extracting, allowing the bees to store in a great many supers. If honey is extracted during a time when the bees are gathering little honey they are always on the lookout for any available stores. Extracting is often done when the bees are gathering heavily and at such times they do not mind the odors from the extracting house, while at other times the least odor of honey starts them off in search of it and if they cannot enter the extracting house they sometimes fall upon weaker hives and rob them of their stores.

The extracting house should be away from other buildings so that the bees when flying around will not annoy persons who may be in the vicinity. The house should be made so that it is absolutely bee-proof: by this is meant that there should be no places were bees could possibly enter from the outside. All windows and doors should be well screened. It is essential to have plenty of windows so that the bees brought in on the frames can have a way of escape after filling themselves with honey. For this reason the screens should be put on the outside of the windows and bee escapes placed at the top so arranged that the bees can easily crawl through them. If regular bee escapes are not used the wire netting which covers the windows should extend four or five inches above the window, leaving a bee-space between the window frames or casings and the screens through which the bees may pass. As it is in the nature of the bees to crawl upwards they find these small openings, but upon returning do not find them.

The extracting house or room should be kept as clean as possible so that no dust or dirt can possibly get into the honey. It should be thoroughly washed before extracting begins and afterwards all articles used in the work should be thoroughly cleaned and dried. It is convenient to have running water in the extracting house as everything can be kept clean more easily.

Ants sometimes become troublesome, but they can be kept

away by spraying around the outside of the building for a few feet with a solution of carbolic acid and water with a little soap added to emulsify it. The carbolic acid should not be used in the house as honey will absorb its odor.

The extractor, uncapping can and utensils used in handling the honey should be so arranged as to facilitate the work. They should be placed on a raised platform so that the honey can run directly into the storage tanks. Directly below the honey gate of the extractor should be hung a large bag made of fine cheese cloth through which the honey is strained as it comes from the extractor. Under this bag a large funnel can be placed through which the honey may run into a barrel, or it may be run into a tank and later on into a barrel. By this method the honey is not handled at all. When a barrel is filled the gate on the receiving tank may be shut and the barrel removed and another put in its place. If barrels are not used for storing honey it may be stored in five gallon cans or large tubs.

A reservoir might be needed below the straining bag as the honey might come too fast from the strainer and the funnel would not be able to take care of it.

The number of men working depends upon the rapidity of uncapping and the amount of honey to be extracted. When a large amount of work is to be done three men work well together, one at the extractor, one uncapping the honey (sometimes two uncap) and one man supplies them with boxes; in his spare time the man supplying the boxes can clean up the frames getting them ready to be returned to the hives. It is always convenient to have a large tub or shallow tank near the men uncapping in which to lay the uncapped frames or the empty ones which come from the extractor. This tub or tank should have a false bottom through which the honey can flow so that the frames will not be standing in honey. The raised platform on which the extractor stands should be large enough so that full boxes of honey can be placed near the uncapper and there should also be sufficient room for empty boxes to be piled near the man doing the extracting so that he can return the empty frames to the boxes at once. After extracting is over all the supers should be cleaned of wax and propolis. This is easily done by using a putty knife or some of the handy scrapers found on the market. The frames should be treated in the same way, removing all the wax which is found on the bars so that there will be no places for moths to work. This is also a good time to remove any irregular comb and repair frames which have been broken. Supers with empty frames should then be neatly piled giving each one the desired number of comb so that they may be returned to the hives late in the afternoon. The best time to return supers to the hives is towards evening or during the evening as the bees will clean up the frames during the night and robbing is less likely to occur. Supers may be returned in the afternoon when there is a heavy flow of honey on. At such times the bees do not show a tendency to rob but, if frames are returned during the day when

a small amount of honey is being gathered it is very liable to start robbing.

EXTRACTORS.

A number of extractors are on the market but most of them are very similar in design. They consist of a large can containing two or more wire baskets wich revolve about a center axis in the can. The uncapped frames are placed in the baskets and, when in motion, the honey is thrown out by centrifugal force. These baskets are connected with a gear operated by a handle on the outside.

The first extractors made had stationary baskets so that the frames of honey had to be taken out and turned in order to extract the other side. At the present time extractors are being used with reversible baskets which does away with the necessity of removing the frames from the cans in order to turn them. There are also automatic reversible extractors on the market which are great labor savers.

UNCAPPING CANS AND KNIVES.

There are a number of different styles of uncapping cans in use. Some are nothing more than a large tank with a sieve placed six inches or a foot from the bottom of the can on which the cappings fall and the honey drains from them falling to the bottom of the can. The cans are generally made of galvanized iron and are always provided with a honey gate to draw off the honey. The honey is strained and added to the honey which comes from the extractor. Uncapping cans of this type are sometimes used as storage tanks after the uncapping has been done. Cappings are left to drain for a number of days, then washed, and the water in which they are cleaned is used for making vinegar. The wax is then melted and placed in tins to cool.

Another kind of uncapping can consists of two tanks, one inside the other and between the two there is a space of one quarter to three-eighths of an inch This space is filled with water and a fire is made below the can to heat it. The heat melts the wax and the honey and melted wax flows out through the honey gate and is collected in tins. It is then allowed to cool and the wax comes to the surface, leaving the clear honey below. The wax is then taken out and the honey added to that which comes from the extractor.

The space between the two cans is used for keeping the uncapping knives warm and clean.

This type of uncapping can is a good time saver as one does not have to bother with washing and molding the wax. Wax collected in this way is very clean and does not need to be rendered as all the particles of pollen and propolis remain in the uncapping can. There are two sets of strainers in the uncapping can, one in which the meshes are much larger than in the other, the inner sieve having the larger meshes of the two. In using uncapping cans of this type all the wax is saved and very little honey is lost.

The person doing the uncapping is supplied with a special knife with a beveled edge so that as he cuts or shaves off the cappings they fall into the uucapping can and do not adhere to the frame. The knife should be kept very sharp and when not in use it should be placed in a pan of warm water as it is easier to uncap when the knife is warm. Many have two knives, keeping one in the water while the other is being used, changing from time to time. These knives have a very long blade, much longer than the width of a frame, so that all the cappings can be removed at once. When one becomes accustomed to using these knives the cappings are removed with very little trouble and the work is done very quickly.

The amount of wax obtained is generally sufficient to pay for the labor of extracting, thus it pays to keep the uncappings.

SHIPMENT OF HONEY.

It is the practice of some of the bee-keepers on the island who live in districts where there are very poor roads and where barrels cannot be handled, to store their honey in five gallon cans setting them aside for transportation. When he is ready to send his honey to market the cans are capped and are transported by mules or burros to the coast. A burro can carry three cans of honey or a load of about one hundred and eighty pounds. One can is placed one on each side, the third is placed directly on the back.

A RECORD OF PRODUCTION.

The following honey records were taken from two hives of bees which have been weighed every morning and evening for a period of 138 and 147 days respectively:

HIVE No. 1.

(Weight at start 128 pounds.)

Date.	Weight.	Amount of increase in honey.	Amount of honey extracted.
December 22, 1910	123 lbs.		
January 20, 1911	155 "	27 lbs.	
" 20, 1911	§ 110 "		45 lbs.
March 7, 1911	177 "	67 "	
" 7, 1911	§ 124 "		53 "
" 25, 1911	177½ "	53½ "	
" 25, 1911	§ 124½ "		53 "
April 3, 1911	187 "	62½	
" 3, 1911	§ 135½ "		51½ "
" 6, 1911	153½ "	19	
" 6, 1911	§ 112 "		41½ "
May 8, 1911	179 "	67 "	
" 8, 1911	§ 128½ "		50½ "
	Total:	296 lbs.	294½ lbs.

HIVE No. 2.

(Weight at start 200½ pounds.)

Date.	Weight.	Amount of increase in honey.	Amount of honey extracted.
December 13, 1910	200½ lbs.		
January 20, 1911	242 "	41½ lbs.	
" 20, 1911	§ 150 "		92 lbs.
April 17, 1911	317 "	167 "	
" 17, 1911	§ 261 "		56 "
" 24, 1911	264 "	3 "	
" 24, 1911	§ 174 "		90 "
May 8, 1911	186 "	12	
" 8, 1911	§ 140 "		46 "
	Total:	223½ lbs.	284 lbs.

(§) Weight after honey was extracted.

Hive No. 1 was started December 22, 1910 and run until May 8, 1911. Hive No. 2 was started December 13, 1910 and the notes kept up to May 8, 1911. The object of this experiment was to find if colonies gathered honey during the winter months, also to learn which are the best honey months and what influence certain plants have on the honey crop. The figures show that there was an increase in the weight of the hives during December, January and February, but both showed the best yields during March, April, and the first part of May; they also indicate that the best honey plant is the guamá, the highest amount of honey gathered in one day while the guama was in bloom being eleven pounds.

We do not consider these hives extraordinary ones; very little work was done to the brood, but they were thought to have plenty of space for raising workers. The queens were raised at the station from Italian stock obtained from the United States. There should be no comparison made between the two hives as one had two supers and the other four, also the queen in hive No. 2 was much older than the one in hive No. 1. The experiment was not started to compare the working ability of the two queens or to see whether two or four supers were best. The experiment as stated above was to get some idea of what could be expected from bees around Mayaguez. As the experiment was run for about 5 months only no estimate can be made of what should be expected for a year's crop. December, January and February, were poor honey months compared to March, April, and the first part of May. The weights are to be kept on these hives for the rest of the year and the notes will appear in another report.

The writer does not wish to give the impression that the above mentioned amount of honey could be expected from every hive in an apiary, but he believes, and it seems probable, that such results could be obtained in well kept hives under favorable conditions. There are always some hives in an apiary which are poor honey producers. These always bring down the average yield per hive.

HONEY PLANTS.

PRINCIPAL HONEY PLANTS.

Coffee.—Coffee is grown over the greater part of the island, the interior being entirely devoted to this one crop. Coffee generally has three blossomings and sometimes four during the year. The flowers last only about a day, but, as all the plants do not blossom at once, the bloom lasts about a week in all. The honey derived from this plant is pure white. Often the coffee bloom comes at the same time as the orange and the combined nectar of these two plants makes a very delicious honey, the flavor of the orange, however, predominating.

Orange.—There are two blossomings generally in cultivated orange groves, the honey flow lasting about three weeks. This flower produces a white honey and it is classed in trade as "the honey of the gods" When there is a heavy flow on, the odor of orange can be noticed around the hives. The honey flow from

the wild orange lasts much longer than from the cultivated, the reason being due to the difference in altitude at which they are found. Those in the low lands blossom first while those in the high lands blossom later on, giving the bees a longer working period.

Guamá.—The number of blossomings of this tree depends on the rainfall. In the coffee sections the guamá is by all means our best honey plant, in fact, it seems to be the best on the island. It also produces pollen. Bees gather only pollen from some plants as the honey is not within their reach, while in other plants it is just the reverse, but the guamá furnishes both nectar and pollen. As these trees are numerous and flowers plentiful we can consider it a most valuable honey tree. The flow is not very long. but there are generally two or three and sometimes even more blossomings during the year. In the coffee districts where the country is mountainous it has been observed that the guamá blossoms in the low lands first and later on in the mountains, making a longer period for the bees to work. The honey is like that of the coffee and orange in color and is considered by many to be very excellent.

Royal palm; Cocoanut palm.—The bees are very fond of working the blossoms of these plants. Just as soon as the blossom sheath begins to open the bees are ready to start work. So many bees work on the blossom that the buzz resembles the noise made in swarming. The royal palm, no doubt, gives a great deal of honey, but nothing like the amount obtained from the guamá, orange, or coffee. I have failed to note that there is ever any general bloom of this tree. The cocoanut furnishes some honey but not as much per tree as the royal palm. The bees, however, seem very ready to work the blossoms.

Moca.—This tree is used as coffee shade. It is an excellent honey plant; it produces great clusters of flowers and blossoms over a very long period. It generally blooms during June and July, but I have noted that the time of blossoming varies a little in different sections.

Jobo.—One of the trees which must not be left out of this list is the jobo. In 1910 it flowered twice although the writer does not know whether this is usual. The flowers are borne in clusters of some three or four hundred flowers each. Three varieties of this tree have been observed; two of them, the jobo amarillo and ciruela del país, are worked by the bees. The former seems to be the better one. The most peculiar thing in regard to this tree is that the bees only work the flowers early in the morning. By nine or ten o'clock the bees are through with the blossoms and are working some other plant, but while they are working these flowers they are very greedy. This plant, I believe, also furnishes a great deal of pollen.

Palo blanco.—This plant is a small shrub and it seems to be of some value as a honey plant. The flowers are borne in clusters at the point where the petiole of the leaves joins the stem, about forty small blossoms to a cluster. The bloom for 1910 was in April. This plant is very abundant in the pastures around Ma-

yagüez. The bees have been observed working this plant while the guamá was in bloom.

Grosellas.—This is another one of our honey plants which should be mentioned. It is a small bush and blossoms during March. The bees work this plant in great numbers. My attention was first brought to the grosellas by the noise of the bees working the blossoms. The plant loses all its leaves during the winter months and then the blossoms appear before tbe leaves.

Higuerillo.—This is a forest tree and the bees work it to a great extent. It blossoms over an extended period and gives the bees much pasture to work upon.

Guara.—Very common in coffee plantations. Blossoms are borne in clusters the same as mango and moca. This plant has a very long blossoming period.

OTHER HONEY PLANTS.

Avocado.—

Guava.—Pollen and honey.

Mango.—Honey and probably some pollen. The bloom runs over a very long period.

Pomarrosa.—This is found in great numbers in the forest.

Tamarind.—

Wild sweet potato.—Of the vines the wild sweet potato seems to be a favorite; the bees go down into the blossoms coming out with their backs covered with a white pollen.

There are a great many ground flowers found in the pastures and even in the coffee plantations. One which should be mentioned is a very troublesome weed called the "Wandering Jew". This plant grows every-where—in the cane, in gardens, and in the coffee. The bees have been observed working this plant and leaving the blossoms with large pellets of pollen on their legs.

There are about three months in the spring—April, May, and the first part of June, when there is a continuous flow of honey. During this season there is an abundance of small shrubs, vines and ground flowers blooming, which in themselves make a heavy honey flow. At the same time there is usually a bloom of either orange, guamá or coffee.

The notes on the foregoing honey plants have been taken around Mayaguez. The periods of blossoming vary slightly in different sections of the island.

The abundance of bloom depends on the amount of rainfall: therefore, in selecting a location for an apiary this should be taken into consideration.

INSECT PESTS AND DISEASES.

ANTS AND COCKROACHES.

Ants many times become troublesome in weak hives and nuclei, but in strong colonies the bees will not permit them to enter. When ants become troublesome around an apiary they

can be destroyed by spraying them with a solution of one-half of one per cent carbolic acid. To make the carbolic acid dissolve in the water put in a small amount of laundry soap. It is always wise to revisit the nest the next day and destroy all the ants which were away at the first application, and which will commence to build a new home. If ants are troublesome around the stands they may be treated in the same way.

Cockroaches will enter weak hives, but strong hives are never troubled by them.

BEE MOTHS.

Bee moths are found on the island, but they occur only when the colonies are weak. Often when colonies lose their queens and there is not a sufficient number of bees to protect the comb the moths enter the hive and their larvae destroys the comb. Stored comb is liable to become infested if it is exposed in any way. Comb not in use should be left on the hives or stored in a dry room, being looked over frequently, and fumigated if necessary, with carbon bisulphide. Caution should be taken in using this preparation as it is very inflamable. Smoking should not be permitted when carbon bisulphide is being used and all fumigating should be done in the day time when lights are not necessary.

To fumigate, the boxes of frames should be piled one on top of another and on the top full box of frames, place half a super in which put a dish containing the carbon bisulphide. The gas is heavier than air and the fumes settle very rapidly and will work down through all the boxes.

Hives with Italian bees are not so often infested with the bee moth as colonies of black bees.

It is a practice of apiarists to place a pure Italian queen in hives which have a tendency to become wormy as the Italian bees are more industrious and will clean up the infested frames.

FOUL BROOD.

Foul brood is the most serious disease which bee-keepers have to contend with. Although it has not been observed in Porto Rico it seems advisable to describe the nature of the disease and to give a list of the channels by which it would spread, if introduced. The following notes, which would apply to Porto Rico, are taken from page 58, Bulletin No. 75, part V, of the Bureau of Entomology, U. S. Department of Agriculture:

> "1. *The nature of the diseases.*—There are now recognized two diseases, virulent and contagious in their character, which attack the brood of the bee. These are known as American foul brood and European foul brood. It is definitely known that American foul brood is caused by a bacterium, *Bacillus larvae*, and from the symptoms and behavior of European foul brood it is almost certain that the latter disease is likewise caused by a micro-organism. There are other diseases recognized by bee keepers, but it is not known that they are infectious.
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> 2. *Methods of spread.*—It is known that both diseases mentioned (European foul brood and American foul brood) are transmitted in the following manner:

(a) By bees from healthy colonies robbing the hives of diseased colonies.

(b) By the bee keeper feeding honey from diseased colonies, as in the case of feeding for winter stores in the colder parts of the mainland.

(c) By the accidental feeding of honey from diseased colonies, which has been extracted and sold in bottles or other containers. (This applies to partly empty honey bottles or cans which may be thrown out carelessly where bees can gain access to them.)

(d) By the introduction of queens taken from apiaries in which disease is present and which are shipped in cages stocked with candy made from infected honey.

It will be obvious from the local conditions that (b) does not apply to the Hawaiian islands. It is doubtless true also that (a) does not apply.....

3. *Means of preventing the introduction of disease to the Hawaiian islands.*— As an immediate action, it is desirable that all queens which are shipped to the Territory be removed from the cages in which they arrive and be introduced to colonies from a clean cage containing candy made from honey free from disease organisms This precaution, which is a very simple operation, will be a very good assurance that disease will not be brought to your islands with imported queens.

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It is above all desirable that no honey of any kind shall be shipped to your islands unless it comes from healthy colonies and is accompanied by a certificate of a qualified inspector of apiaries that such is the case. This precaution is of much more importance than those against infection through importation of queens. The bee keeper who imports queens would probably soon recognize disease if it appeared in a colony containing a choice imported queen, but if disease is brought in with honey it might gain a strong foothold before its discovery.....

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On September 3, 1910, the legislative assembly of Porto Rico in special session approved Act No. 60, to prevent the introduction into Porto Rico of plant and insect diseases, and for other purposes. Said act, section 5, provides: "That no bee comb, larvae, pupae, or bees, shall be brought into Porto Rico from any other place; Provided that queen bees accompanied by not more than thirty (30) worker bees and without bee comb containing eggs, larvae, pupae, or bees, may be introduced therein in mailing cages, or small boxes."